DMV Annual Conference 2022

Section S03: Algebraic Geometry

Session 1 (Monday 11:00-13:00)
1. Christian Liedtke (60 min)
2. Nero Budur (60 min)

Session 2 (Monday 15:30-17:30)
1. Alex Küronya (60 min)
2. Ana Botero (60 min)

Session 3 (Tuesday 10:30-12:30)
1. Mihai Paun (60 min)
2. Patrick Graf (30 min)
3. Frank Gounelas (30 min)

Session 4 (Wednesday 10:30-12:30)
1. Catharina Stroppel (60 min)
2. Camilla Felisetti (30 min)
3. Yajnaseni Dutta (30 min)

Session 5 (Wednesday 15:30-17:30)
1. Bernd Sturmfels (60 min)
2. Marta Panizzut (30 min)
3. Scott Mullane (30 min)

Session 6 (Thursday 10:30-12:30)
1. Charles Vial (60 min)
2. Giuseppe Ancona (60 min)

Session 7 (Thursday 15:30-17:30)
1. Kestutis Cesnavicius (60 min)
2. Katharina Hübner (30 min)
3. Andrea Di Lorenzo (30 min)

Abstracts

Giuseppe Ancona
Algebraic classes in mixed characteristic and André's p-adic periods

(Joint work with D. Fratila) Motivated by the study of algebraic classes in mixed characteristic, we define a countable subalgebra of Q_p which we call the algebra of „André's p-adic periods". We will explain the analogy and the difference between these p-adic periods and the classical complex periods. For instance, they both contain several examples of special values of classical functions (logarithm, gamma function, ...) and they share transcendence properties. On the other hand, the classical Tannakian formalism which is used to bound the transcendence degree of complex periods has to be modified in order to be used in the p-adic setting. We will discuss concrete examples of all these instances though elliptic curves and Kummer extensions.

Ana Botero
Chern-Weil theory for toroidal metrics on line bundles

Using the theory of b-divisors and non-pluripolar products we show that Chern-Weil theory and a Hilbert Samuel theorem can be extended to a wide class of singular semi-positive metrics. We then apply these results to study the line bundle of Siegel-Jacobi forms on the universal abelian variety with the Peterson metric. We show on the one hand that the ring of Siegel-Jacobi forms of constant positive relative index is never finitely generated, and on the other, we recover a formula of Tai giving the asymptotic growth of the dimension of the spaces of Siegel-Jacobi modular forms. This is joint work with J. Burgos Gil, R. de Jong and D. Holmes.

Nero Budur
Bernstein-Sato ideals

We report on the proof a conjecture relating the Bernstein-Sato ideal of a finite collection of multivariate polynomials with cohomology support loci of rank one complex local systems. This generalizes a classical theorem of Malgrange and Kashiwara relating the b-function of a multivariate polynomial with the monodromy eigenvalues on the Milnor fibers cohomology. Joint work with Robin van der Veer, Lei Wu, Peng Zhou.

Kestutis Cesnavicius
Reductive group torsors on a complement of a smooth divisor

A conjecture of Nisnevich predicts that for a smooth variety X over a field, a smooth divisor D in X, and a totally isotropic reductive X-group scheme G, every generically trivial G-torsor on X\setminus D trivializes Zariski locally on X. I will discuss this conjecture and related questions about torsors under reductive groups over regular rings.

Andrea Di Lorenzo
Cohomological invariants of moduli of curves and Brauer groups

The Brauer group is a fundamental invariant that plays an important role both in rationality problems and arithmetic. Nevertheless, computations of Brauer groups of moduli stacks only started appearing recently. In this talk I will explain how the theory of cohomological invariants with coefficients in motivic étale cohomology can be used to obtain explicit presentations of Brauer groups of some moduli of curves, e.g. moduli of hyperelliptic curves and their compactifications over a field of characteristic zero, and moduli of elliptic curves over any base field. Joint work with Roberto Pirisi.

Yajnaseni Dutta
Birational automorphisms of hyperkähler manifolds of K3[n]-type

Birational self-maps that are not biregular are hard to find on hyperkähler manifolds. For instance, there aren't any on K3 surfaces. In this joint work with D. Mattei and Y. Prieto we showed that a general projective Hyperkähler manifold that is deformation equivalent to the Hilbert scheme of n-points on a K3 surface (i.e. of K3[n]-type) cannot admit certain birational self-maps of finite order. This prompted us to investigate birational self-maps moduli of sheaves on K3 surfaces which are of K3[n]-type. Using Markman's theory of hyperkähler lattices and Bayer-Macri's study of Bridgeland stability on K3 surfaces, we impose explicit numerical constraints on the topological invariants of the sheaves so that certain birational involution exists on their moduli space.

Camilla Felisetti
P=W phenomena on singular moduli spaces

Irreducible holomorphic symplectic (IHS) varieties can be thought as a generalization of hyperkähler manifolds allowing singularities. Among them we can find for example moduli spaces of sheaves on K3 and abelian surfaces, which have been recently shown to play a crucial role in non abelian Hodge theory. After recalling the main features of IHS varieties, I will present several results concerning their intersection cohomology and the perverse filtration associated with a Lagrangian fibration, establishing a compact analogue of the celebrated P=W conjecture by de Cataldo, Hausel and Migliorini for varieties which admit a symplectic resolution. The talk is based on joint works with Mirko Mauri, Junliang Shen and Qizheng Yin.

Frank Gounelas
Curves on K3 surfaces

I will discuss recent results on existence and deformation theory of curves of geometric genus $g \geq 0$ on complex projective K3 surfaces.

Patrick Graf
Uniformization of compact Kähler spaces

It is well-known that the universal cover of a compact Riemann surface is either the projective line, the affine line or the unit disc. The higher-dimensional version of this result concerns compact Kähler manifolds whose canonical bundle is either trivial or (anti-)ample. In recent years, singular Kähler spaces have come into focus due to their appearance in birational geometry. I will report on some recent progress in this direction (joint with B. Claudon and H. Guenancia).

Katharina Hübner
The wild ramification locus

We study the notions of wild and tame ramification in arithmetic geometry. Wildly ramified morphisms tend to behave very differently from what we know about ramification phenomena in characteristic zero. We discuss several approaches to define tame covering spaces and explain how valuative spaces such as adic spaces or

Berkovich spaces naturally enter the picture. Points of these spaces are certain valuations, such as discrete valuations coming from a divisor. But in general these valuations tend to be complicated. By analytic methods we show, however, that we can check tameness on divisors.

Alex Küronya
Newton-Okounkov bodies and measures of local positivity

Newton-Okounkov bodies are a convex-geometric way to understand the vanishing behaviour of global sections of line bundles in an asymptotic sense. While they have interesting connections with a variety of mathematical topics including representation theory, Diophantine approximation, and mathematical physics, here we will focus on their relationship with birational geometry. More specifically, we will see how they encode local positivity of line bundles and how they give rise to interesting invariants that are mostly unexplored even in the toric case.

Christian Liedtke
McKay Correspondences for Finite and Linearly Reductive Group Schemes

We establish McKay correspondences for finite and linearly reductive subgroup schemes of SL(2) in positive characteristic. As an application, we obtain a McKay correspondence for all rational double point singularities in characteristic $p>5$.

Scott Mullane
The birational geometry of the moduli space of pointed hyperelliptic curves

The moduli space of pointed hyperelliptic curves is a seemingly simple object with perhaps unexpectedly interesting geometry. I will report on joint work with Ignacio Barros completing the classification of both the Kodaira dimension and the structure of the effective cone of these moduli spaces.

Mihai Paun
Extension of pluricanonical forms on compact Kähler manifolds

I will present a joint work (in progress) with J. Cao. It concerns extension of

pluricanonical forms defined on the central fiber of a smooth proper family of Kähler manifolds. The main techniques we are developing have their origin in a work of M. Levine in the 80's.

Catharina Stroppel
Fukaya categories from representation theory

Khovanov homology can be constructed using quite different tools. I particularly there exists representation theoretic and symplectic geometric constructions involving Fukaya categories associated with nilpotent slices. I will briefly recall some of this, but then focus on giving a representation theoretic approach to these Fukaya categories. The talk will be a combination of a short summary and new joint results with Jens Eberhardt connecting Floer homology with cohomology of Richardson varieties which I will explain in detail.

Marta Panizzut
Tropical curves: geometry, enumeration and computations

Many exciting research topics lie at the interface between polyhedral and algebraic geometry creating fruitful grounds for new computational methods. Tropical geometry has recently fueled these interactions, providing a systematic framework to study degenerations of algebraic varieties. In this talk, I exhibit examples of these aspects focusing on polyhedral computations at the core of the study of curves and their enumerative properties over the real numbers through tropical lenses.

Bernd Sturmfels
Recovery of Plane Curves from Branch Points

We recover plane curves from their branch points under projection onto a line. Our focus lies on cubics and quartics. These have 6 and 12 branch points respectively. The plane Hurwitz numbers 40 and 120 count the orbits of solutions. We determine the numbers of real solutions, and we present exact algorithms for recovery. Our approach relies on 150 years of beautiful algebraic geometry, from Clebsch to Vakil and beyond. this is joint work with Daniele Agostini, Hannah Markwig, Clemens Nollau, Victoria Schleis and Javier Sendra-Arranz.

Charles Vial

On the algebraicity of de Rham-Betti classes for products of elliptic curves

A de Rham-Betti class on a smooth projective variety X over a number field K is a rational class in the Betti cohomology of the analytification of X that descends to a class in the algebraic de Rham cohomology of X via the period comparison isomorphism. These classes are the analogues of Hodge classes, except that one uses the K-structure on de Rham cohomology instead of the Hodge filtration. The period conjecture of Grothendieck implies that de Rham–Betti classes should be algebraic. I will report on joint work with Mingmin Shen, where we prove that any de Rham–Betti class on a product of elliptic curves is algebraic. As a key intermediate step in the proof, we show that certain codimension-2 de Rham-Betti classes on hyper-Kähler varieties are Hodge.